

## WHAT IS CLAIMED IS:

- 1     1.     An apparatus with a dual-writing function comprising:
  - 2             a first module for controlling an interface to an
  - 3     external apparatus;
  - 4             a plurality of second modules each having a cache
  - 5     memory; and
  - 6             a bridge module connected through an interface bus
  - 7     to said first and second modules for accomplishing a
  - 8     connection between said first module and said second module
  - 9     for data transfer therebetween,
  - 10            said first module including address designation means
  - 11    for producing addressing information to designate two
  - 12    written-in destinations for writing data to be written,
  - 13    which is received from said external apparatus, through
  - 14    said bridge module into said cache memories of two of said
  - 15    plurality of second modules, and
  - 16            said bridge module including:
    - 17                address production means for analyzing said
    - 18                addressing information, which is received together with
    - 19                said data to be written from said first module, to produce
    - 20                two transferred-to addresses for designation of said two
    - 21                second modules having said cache memories in which said
    - 22                data is to be actually written and to produce written-in
    - 23                addresses in said cache memories; and
    - 24                data transfer control means for controlling data
    - 25                transfer from said bridge module to said second modules
    - 26                so that, after said data is transferred to the two second

27 modules corresponding to said two transferred-to addresses,  
28 said data is written at said written-in address in said  
29 cache memory of each of the two second modules.

1 2. The apparatus with a dual-writing function according  
2 to claim 1, wherein said address designation means  
3 designates, in said addressing information, a page address  
4 in said cache memory of each of said second modules and  
5 an offset address in a page designated by said page address,  
6 as said written-in address for said data in said cache memory.

1 3. The apparatus with a dual-writing function according  
2 to claim 2, wherein said address designation means  
3 designates, in said addressing information, specific  
4 information for specifying said two second modules having  
5 said cache memories in which said data is to be actually  
6 written, as said two transferred-to addresses for said data.

1 4. The apparatus with a dual-writing function according  
2 to claim 3, wherein said interface bus is a PCI (Peripheral  
3 Component Interconnect) bus, and numbers for specifying  
4 said PCI buses for said two second modules are designated  
5 as said specific information.

1 5. The apparatus with a dual-writing function according  
2 to claim 1, wherein each of said second modules includes  
3 management means for managing information on the second  
4 module which is in mirror relation to this second module

5 and for managing the association between a master area  
6 address in said cache memory in this second module and a  
7 mirror area address in said cache memory of the second module  
8 being in the mirror relation to this second module, and  
9 said address designation means of said first module produces  
10 said addressing information on the basis of information  
11 acquired from said management means of one of the two second  
12 modules.

1 6. The apparatus with a dual-writing function according  
2 to claim 2, wherein each of said second modules includes  
3 management means for managing information on the second  
4 module which is in mirror relation to this second module  
5 and for managing the association between a master area  
6 address in said cache memory in this second module and a  
7 mirror area address in said cache memory of the second module  
8 being in the mirror relation to this second module, and  
9 said address designation means of said first module produces  
10 said addressing information on the basis of information  
11 acquired from said management means of one of the two second  
12 modules.

1 7. The apparatus with a dual-writing function according  
2 to claim 3, wherein each of said second modules includes  
3 management means for managing information on the second  
4 module which is in mirror relation to this second module  
5 and for managing the association between a master area

6 address in said cache memory in this second module and a  
7 mirror area address in said cache memory of the second module  
8 being in the mirror relation to this second module, and  
9 said address designation means of said first module produces  
10 said addressing information on the basis of information  
11 acquired from said management means of one of the two second  
12 modules.

1 8. The apparatus with a dual-writing function according  
2 to claim 4, wherein each of said second modules includes  
3 management means for managing information on the second  
4 module which is in mirror relation to this second module  
5 and for managing the association between a master area  
6 address in said cache memory in this second module and a  
7 mirror area address in said cache memory of the second module  
8 being in the mirror relation to this second module, and  
9 said address designation means of said first module produces  
10 said addressing information on the basis of information  
11 acquired from said management means of one of the two second  
12 modules.

1 9. The apparatus with a dual-writing function according  
2 to claim 5, wherein, in a case in which a capacity of a  
3 master area of said cache memory runs short when data to  
4 be read out through said bridge module into said first module  
5 is temporarily preserved in the cache memory, each of said  
6 second modules preserves the readout data in a mirror area

7 of said cache memory of the second module, which is in the  
8 mirror relation to this second module, on the basis of a  
9 situation of management by said management means.

1 10. The apparatus with a dual-writing function according  
2 to claim 6, wherein, in a case in which a capacity of a  
3 master area of said cache memory runs short when data to  
4 be read out through said bridge module into said first module  
5 is temporarily preserved in the cache memory, each of said  
6 second modules preserves the readout data in a mirror area  
7 of said cache memory of the second module, which is in the  
8 mirror relation to this second module, on the basis of a  
9 situation of management by said management means.

1 11. The apparatus with a dual-writing function according  
2 to claim 7, wherein, in a case in which a capacity of a  
3 master area of said cache memory runs short when data to  
4 be read out through said bridge module into said first module  
5 is temporarily preserved in the cache memory, each of said  
6 second modules preserves the readout data in a mirror area  
7 of said cache memory of the second module, which is in the  
8 mirror relation to this second module, on the basis of a  
9 situation of management by said management means.

1 12. The apparatus with a dual-writing function according  
2 to claim 8, wherein, in a case in which a capacity of a  
3 master area of said cache memory runs short when data to

4 be read out through said bridge module into said first module  
5 is temporarily preserved in the cache memory, each of said  
6 second modules preserves the readout data in a mirror area  
7 of said cache memory of the second module, which is in the  
8 mirror relation to this second module, on the basis of a  
9 situation of management by said management means.

1 13. An apparatus with a dual-writing function comprising:  
2 a first module for controlling an interface to  
3 an external apparatus;  
4 a plurality of second modules each having a cache  
5 memory; and  
6 a bridge module connected through an interface  
7 bus to said first and second modules for accomplishing a  
8 connection between said first module and said second module  
9 for data transfer therebetween,  
10 said first module writing data to be written, which  
11 is received from said external apparatus, through said  
12 bridge module into said cache memories of two of said  
13 plurality of second modules, and  
14 each of said second modules including management means  
15 for managing information on the second module which is in  
16 mirror relation to this second module and for managing the  
17 association between a master area address in said cache  
18 memory in this second module and a mirror area address in  
19 said cache memory of the second module being in the mirror  
20 relation to this second module.

1 14. The apparatus with a dual-writing function according  
2 to claim 13, wherein, in a case in which a capacity of a  
3 master area of said cache memory runs short when data to  
4 be read out through said bridge module into said first module  
5 is temporarily preserved in the cache memory, each of said  
6 second modules preserves the readout data in a mirror area  
7 of said cache memory of the second module, which is in the  
8 mirror relation to this second module, on the basis of a  
9 situation of management by said management means.

1 15. A storage control apparatus placed between a disk unit  
2 and a host for controlling access to said disk unit by said  
3 host, said storage control apparatus comprising:  
4 a disk interface module for controlling an interface  
5 to said disk unit;  
6 a host interface module for controlling an interface  
7 to said host;  
8 a plurality of management modules, each including a  
9 cache memory, for generally controlling the entire  
10 apparatus; and  
11 a bridge module connected through an interface bus  
12 to said disk interface module, said host interface module  
13 and said management modules for making connections among  
14 said disk interface module, said host interface module and  
15 said management modules for data transfer among said  
16 modules,

17           said host interface module including:  
18           address designation means for producing  
19   addressing information to designate two written-in  
20   destinations for writing data to be written, which is  
21   received from said host, through said bridge module into  
22   said cache memories of two of said plurality of management  
23   modules, and  
24           said bridge module including:  
25           address production means for analyzing said  
26   addressing information, which is received together with  
27   said data to be written from said host interface module,  
28   to produce two transferred-to addresses for designation  
29   of said two management modules having said cache memories  
30   in which said data is to be actually written and to produce  
31   written-in addresses in said cache memories; and  
32           data transfer control means for controlling data  
33   transfer from said bridge module to said management modules  
34   so that, after said data is transferred to the two management  
35   modules corresponding to said two transferred-to addresses,  
36   said data is written at said written-in address in said  
37   cache memory of each of the two management modules.

1   16.   The storage control apparatus according to claim 15,  
2   wherein said address designation means designates, in said  
3   addressing information, a page address in said cache memory  
4   of each of said management modules and an offset address  
5   in a page designated by said page address, as said written-in



6 address for said data in said cache memory.

1 17. The storage control apparatus according to claim 16,  
2 wherein said address designation means designates, in said  
3 addressing information, specific information for  
4 specifying said two management modules having said cache  
5 memories in which said data is to be actually written, as  
6 said two transferred-to addresses for said data.

1 18. The storage control apparatus according to claim 17,  
2 wherein said interface bus is a PCI (Peripheral Component  
3 Interconnect) bus, and numbers for specifying said PCI buses  
4 for said two management modules are designated as said  
5 specific information.

1 19. The storage control apparatus according to claim 15,  
2 wherein each of said management modules includes management  
3 means for managing information on the management module  
4 which is in mirror relation to this management module and  
5 for managing the association between a master area address  
6 in said cache memory in this management module and a mirror  
7 area address in said cache memory of the management module  
8 being in the mirror relation to this management module,  
9 and said address designation means of said host interface  
10 module produces said addressing information on the basis  
11 of information acquired from said management means of one  
12 of the two management modules.

1    20.    The storage control apparatus according to claim 16,  
2    wherein each of said management modules includes management  
3    means for managing information on the management module  
4    which is in mirror relation to this management module and  
5    for managing the association between a master area address  
6    in said cache memory in this management module and a mirror  
7    area address in said cache memory of the management module  
8    being in the mirror relation to this management module,  
9    and said address designation means of said host interface  
10   module produces said addressing information on the basis  
11   of information acquired from said management means of one  
12   of the two management modules.

1    21.    The storage control apparatus according to claim 17,  
2    wherein each of said management modules includes management  
3    means for managing information on the management module  
4    which is in mirror relation to this management module and  
5    for managing the association between a master area address  
6    in said cache memory in this management module and a mirror  
7    area address in said cache memory of the management module  
8    being in the mirror relation to this management module,  
9    and said address designation means of said host interface  
10   module produces said addressing information on the basis  
11   of information acquired from said management means of one  
12   of the two management modules.

1    22.    The storage control apparatus according to claim 18,

2 wherein each of said management modules includes management  
3 means for managing information on the management module  
4 which is in mirror relation to this management module and  
5 for managing the association between a master area address  
6 in said cache memory in this management module and a mirror  
7 area address in said cache memory of the management module  
8 being in the mirror relation to this management module,  
9 and said address designation means of said host interface  
10 module produces said addressing information on the basis  
11 of information acquired from said management means of one  
12 of the two management modules.

1 23. The storage control apparatus according to claim 19,  
2 wherein, in a case in which a capacity of a master area  
3 of said cache memory runs short when data read out from  
4 said disk unit through said disk interface module and said  
5 bridge module is temporarily preserved in the cache memory,  
6 each of said management modules preserves the readout data  
7 in a mirror area of said cache memory of the management  
8 module, which is in the mirror relation to this management  
9 module, on the basis of a situation of management by said  
10 management means.

1 24. The storage control apparatus according to claim 20,  
2 wherein, in a case in which a capacity of a master area  
3 of said cache memory runs short when data read out from  
4 said disk unit through said disk interface module and said

5 bridge module is temporarily preserved in the cache memory,  
6 each of said management modules preserves the readout data  
7 in a mirror area of said cache memory of the management  
8 module, which is in the mirror relation to this management  
9 module, on the basis of a situation of management by said  
10 management means.

1 25. The storage control apparatus according to claim 21,  
2 wherein, in a case in which a capacity of a master area  
3 of said cache memory runs short when data read out from  
4 said disk unit through said disk interface module and said  
5 bridge module is temporarily preserved in the cache memory,  
6 each of said management modules preserves the readout data  
7 in a mirror area of said cache memory of the management  
8 module, which is in the mirror relation to this management  
9 module, on the basis of a situation of management by said  
10 management means.

1 26. The storage control apparatus according to claim 22,  
2 wherein, in a case in which a capacity of a master area  
3 of said cache memory runs short when data read out from  
4 said disk unit through said disk interface module and said  
5 bridge module is temporarily preserved in the cache memory,  
6 each of said management modules preserves the readout data  
7 in a mirror area of said cache memory of the management  
8 module, which is in the mirror relation to this management  
9 module, on the basis of a situation of management by said

10 management means.

1 27. A storage control apparatus placed between a disk  
2 unit and a host for controlling access to said disk unit  
3 by said host, said storage control apparatus comprising:  
4 a disk interface module for controlling an interface  
5 to said disk unit;  
6 a host interface module for controlling an interface  
7 to said host;  
8 a plurality of management modules for generally  
9 controlling the entire control unit; and  
10 a bridge module connected through an interface bus  
11 to said disk interface module, said host interface module  
12 and said management modules for making connections among  
13 said disk interface module, said host interface module and  
14 said management modules for data transfer among said  
15 modules,  
16 said host interface module writing data to be written,  
17 which is received from said host, through said bridge module  
18 into cache memories of two of said plurality of management  
19 modules, and  
20 each of said management modules including management  
21 means for managing information on the management module  
22 which is in mirror relation to this management module and  
23 for managing the association between a master area address  
24 in said cache memory in this management module and a mirror  
25 area address in said cache memory of the management module

26 being in the mirror relation to this management module.

1 28. The storage control apparatus according to claim 27,  
2 wherein, in a case in which a capacity of a master area  
3 of said cache memory runs short when data read out from  
4 said disk unit through said disk interface module and said  
5 bridge module is temporarily preserved in the cache memory,  
6 each of said management modules preserves the readout data  
7 in a mirror area of said cache memory of the management  
8 module, which is in the mirror relation to this management  
9 module, on the basis of a situation of management by said  
10 management means.